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AHRI Comments â€“ Title 24-2025 Pre-Rulemaking Express Terms [Docket No 22-BSTD-01]

Additional submitted attachment is included below.

November 17, 2023

California Energy Commission (CEC)
Docket Unit, MS-4
1516 Ninth Street
Sacramento, California 95814-5512

(Submitted electronically to Docket 22-BSTD-01)

Re: AHRI Comments – Title 24-2025 Pre-Rulemaking Express Terms *[Docket No. 22-BSTD-01]*

Dear CEC Staff:

The Air-Conditioning, Heating, and Refrigeration Institute (AHRI) respectfully submits this letter in response to the California Energy Commission (CEC) 2025 Pre-Rulemaking Express Term proposed changes to Energy Code (Title 24, Part 6), published on Friday, November 3, 2023.

AHRI represents more than 300 air-conditioning, heating, and refrigeration equipment manufacturers. In North America, the annual output of the heating, ventilation, air conditioning, and refrigeration (HVACR) and water heating industry is worth more than $44 billion. In the United States, the industry supports 1.3 million jobs and $256 billion in economic activity annually.

Heat Pump Baseline

The CEC is proposing prescriptive requirements to install both heat pump space and water heaters in residential and nonresidential buildings with little to no published technical support document to justify these changes. The information published by CEC, to date, is insufficient for appropriate stakeholder analysis of changes to prescriptive requirements for water heaters and space conditioning systems in residential and nonresidential buildings. At the July 27th workshop, the CEC first presented the proposal to prescriptively require installation of both heat pump space and water heaters in all residential and many nonresidential buildings. However, no material was provided in advance to prepare stakeholders for meaningful discussion at the workshop. In addition, the slide deck was posted to the docket several days later. At that meeting, and in subsequent written comments, AHRI requested CEC publish a technical support document or staff report and draft code language relating to the measure.[1,2]

Again, at the second HP Baseline Workshop held on August 24th only a slide deck was published to the docket, without the technical support documents. AHRI again reiterated its

[1] CEC Single Family Heat Pump Documentation (Docket 21-BSTD-01, TN#238850), filed on July 14, 2021.
[2] CEC Nonresidential Heat Pump Documentation (Docket 21-BSTD-01, TN#238849), filed on July 14, 2021.

request for the immediate publication of technical support of changes to residential and nonresidential baselines.

AHRI expects that any technical support document will address previous CEC assertions that moving to an all-electric baseline was premature in the 2022 code.[3] The CEC identified that neither the market, nor the workforce was ready to support electric-only new construction. AHRI understood that the 2022 Energy Code did not contain an all-electric mandate and that natural gas appliances may still be installed via the performance pathway. However, changes made to the baseline, starting in 2022 and expanded here, have made the installation of natural-gas appliances more expensive, as additional efficiency measures are required in conjunction with these products.

As presented on July 27th, it's not clear that a homeowner can install both natural gas space and water heating equipment. In many California Climate Zones (CCZ), the homeowner would need to install triple pane windows, verified low leakage ducts in conditioned spaces, an ERV, and a *0.7 solar fraction domestic hot water heater*. Solar hot water heaters are niche systems and require (1) one or more solar collectors, which can occupy 40-50 square feet of roof area; (2) a heat exchanger tank; (3) pumps; (4) a thermal expansion tank; and (5) an auxiliary water heater. Title 24 also gives mandatory requirements for unfired service water heater storage tanks and backup tanks for solar water-heating systems in Section 110.3 and 150.0(j). In an Energy Saver article, the Department of Energy (DOE) estimates the cost for household-sized solar water heater systems to be on the order of $100/sf.[4] In the same article, DOE notes that in areas where the energy costs are higher national average, such as California, the paybacks are lower, and it is in those areas where most installation activity occurs. In a review of the Solar Rating & Certification Corporation (ICC-SRCC™) certified directory,[5] the minimum annual solar savings fraction of 0.7 specified prescriptively in Section 150.1(c)8.C cannot be met in CCZ1. Section 150.1(c)8C also prescriptively requires an *electric* auxiliary water heater with installation criteria specified in Reference Residential Appendix RA4. AHRI questions if the example package CEC presented is a feasible option available in the performance path for a homeowner to install both natural gas space and water heating products in a single-family home or multifamily unit.

To use only one heat pump, the homeowner would be required to install a high efficiency dual-fuel heat pump (95% AFUE/16 SEER2/8 HSPF) or 0.95 UEF gas water heater,[6] triple pane windows, and a 5 kWh battery. For the single replacement, the homeowner incurs additional expense and would be required to install either a gas water heater or furnace that exceeds federal energy standards. CEC provided no example of what would be required if a homeowner were to install a federally-compliant gas water heater and minimum efficiency heat pump. These very expensive tradeoffs essentially force an all-electric baseline, which basically bans the use of natural gas equipment. System selection beyond the limited prescriptive path also forces home

[3] Comment made by CEC staff at a Title 24-2022 workshop on January 26, 2021.
[4] DOE Energy Saver, Estimating the Cost and Energy Efficiency of a Solar Water Heater. Available, here: https://www.energy.gov/energysaver/estimating-cost-and-energy-efficiency-solar-water-heater
[5] Solar Rating & Certification Corporation Directory is available, here: https://solar-rating.org/
[6] Household gas water heaters are required to have a UEF of at least 0.64.

and business owners to use the performance path and model the building.[7] CEC needs to address the cost imposed by limiting the consumer or homeowner to select systems in the prescriptive path.

The CEC also needs to address any changes it has observed to the market or the workforce that would support what amounts to an all-electric baseline for residential and non-residential buildings. In the 2022 Energy Code development, CEC stated that neither the market, nor the workforce was ready for a potential significant increase in all-electric buildings. Technicians of heat pumps must be trained to the latest of both technical and professional standards. Consumers in California are not ready for policies limiting a consumer's choice to freely select equipment.

Rather than regulations preventing the use of energy sources for space- and/or water-heating, the CEC should focus on incentives for reducing carbon emissions through policies that encourage the installation of equipment that reduces carbon emissions and structural updates that reduce the amount of energy needed for space- and/or water-heating. It is imperative that the CEC preserve the flexibility for equipment to use any energy source when it is economically and environmentally beneficial to do so.[8]

Long-term System Cost

CEC has proposed using a new metric, Long-term System Cost (LSC), to evaluate cost-effectiveness for proposed measures, including impactful changes to the HP Baseline, and within Title 24's compliance software (Section 10-109), in the performance approach.[9] If adopted, LSC will also be used for code compliance with the performance path. Software, developed by the Energy Code, implements simulation and compliance rules to simulate the energy use of a proposed residential or nonresidential building and compares it to a standard design energy budget to determine if the building complies with the Energy Efficiency Standards.

While two presentations were made regarding metric changes in 2022, no detailed technical information has been made available. It is imperative that CEC make details available on the fundamental approach, and assumptions being used, to cost justify measures for the Energy Code that impacts all buildings in California. For example, California receives a sizable amount of zero-carbon emissions energy from the Diablo Canyon nuclear generator – it generates 8.5% of all California's in-state generation.[10] The current operating licenses for Diablo

[7] In response to the 2022 Title 24-2022 15-Day Express Terms (Docket No. 21-BSTD-01), AHRI submitted comments detailing market preferences for the performance path compared to the prescriptive path. CEC has never addressed these comments. AHRI requests CEC consider the burden that required modeling will have on California home and business owners.

[8] In written comments filed on August 9, 2023 in response to the July 27, 2023 stakeholder workshop, AHRI raised several technical and cost concerns with the heat pump baseline proposal. (Docket 21-BSTD-01, TN# 251553) AHRI expects these concerns to be addressed in the forthcoming staff report.

[9] Title 24-2025 Pre-rulemaking Express Terms, Section 140.1 – Performance Approach: Energy Budget, (Docket 21-BSTD-01, TN# 252915)

[10] CEC 2021 Total System Electric Generation (most recent year available). https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/2021-total-system-electric-generation

Canyon (DCPP) Units 1 and 2, expire on November 2, 2024, and August 26, 2025,[11] but there are no publicly available plans for replacement – zero emissions or other. On September 2, 2022, the State of California enacted Senate Bill No. 846 (SB 846), which invalidated and reversed the 2018 California Public Utilities Commission (CPUC) decision to approve termination of PG&E's license renewal application and retirement of DCPP Units 1 and 2. On October 26, 2023 the CPUC proposed to extend the retirement dates to 2029 (Unit 1) and 2030 (Unit 2).[12] The proposal is subject to approval by the United States Nuclear Regulatory Commission and contingent upon the $1.4 billion loan agreement authorized by SB 846. Diablo Canyon is also the subject of ongoing petition to shutter the power plant.[13] In short, there is much volatility in Diablo Canyon's future and no plans on renewables to replace it in 2025, or 2030. How does the LSC and source energy forecast account for the variables involved with the eventual power plant closure? How are other long-term changes addressed within the 30-year period? How accurate are these forecasts? How sensitive is the analysis? What alternatives were analyzed in the scenario selection process for the 2025 hourly factors?[14] CEC must educate stakeholders to explain and justify the use of LSC.

LSC appears to modify the hourly source energy (HSE), and likewise, AHRI expects LSC to be forecasted differently for electricity, gas, and propane consumption, based on planned changes for each fuel.[15] But these details have not been made public, despite the presentation of LSC for the first time over one year ago. If LSC is similar to HSE, why is CEC now making efforts to fully replace it? HSE was contemplated by CEC to "complement the time dependent valuation (TDV) metric."[16] AHRI also requests the CEC clarify how HSE was used in measure development and code compliance Title 24-2022. The California 2021 Integrated Energy Policy Report (IEPR) states that, "to comply with the Energy Code, the TDV and HSE target budgets must be met independently by the building design," but AHRI finds no reference to HSE in the Express Terms document.

TDV is used in Title 24-2022, for comparing proposed building design to their energy budget when using the performance compliance approach. TDV is based on the concept that the energy impacts of a building energy feature should be valued when energy is consumed and has

[11] Nuclear Regulatory Commission Decision Approving Retirement of Diablo Canyon Nuclear Power Plant, Application 16-8-006. Decision 18-01-022, January 11, 2018. https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M205/K423/205423920.PDF

[12] California Public Utilities Commission October 26, 2023 proposed *Decision Conditionally Approving Extended Operations at Diablo Canyon Nuclear Power Plant Pursuant to Senate Bill 846*. https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M520/K614/520614035.PDF

[13] Kaur, A. (2023, September 15). Advocates urge feds to shut off reactor at California's last nuclear plant. Washington Post. https://www.washingtonpost.com/climate-environment/2023/09/14/diablo-canyon-nuclear-reactor-closure-danger/

[14] Slide 19 from the November 10, 2022 Energy Accounting Workshop (Docket 22-BSTD-01 TN# 248216)

[15] Slide 21 from the November 10, 2022 Energy Accounting Workshop (Docket 22-BSTD-01 TN# 248216) provides high-level forecast demand and applies an 8% annual growth cap on forecasted systemwide residential gas costs.

[16] The Final 2021 Integrated Energy Policy Report Volume I Building Decarbonization (Docket 21-IPER-01, TN# 241361) has a chapter devoted to California Energy Code — Time-Dependent Valuation and Hourly Source Energy Metrics (pg. 20).

been described by CEC as being, reflective of the "actual cost of energy to consumers and to the grid."[17] The CEC has proposed that the 2025 energy code state,

> "The Energy Budget for newly constructed, low-rise residential buildings are expressed in terms of the Long-Term System Cost (LSC) and Source Energy. Additionally for newly constructed single-family buildings, the energy budget includes peak cooling energy. The Energy Budget for additions and alterations are expressed in terms of LSC."[18]

LSC is defined in Section 100.1 of the draft 2025 Express Terms as, "the present value of costs over a 30-year period related to California's energy system." Like HSE, LSC factors are used to convert predicted site energy use to long-term dollar costs to California's energy system. LSC is used in conjunction with "long run marginal source energy of *fossil fuels* following the long-term effects of any associated changes in resource procurement, focusing on the amount of fossil fuels that are combusted in association with demand-side energy consumption."[19] It is unclear why the 2025 Energy Code has proposed only using source energy for fossil fuel, when CEC has in the past acknowledged that, source energy is the, "total system input energy (in the form of fuel *including both natural gas and electricity*) that is required to serve building loads."[20] AHRI requests CEC confirm that source energy is being accounted for all energy sources.

AHRI also requests CEC explain how the 30-year period that LSC captures applies to the energy use of covered products, which have a markedly shorter average lifetime. CEC should be aware of the timing disconnect between products and LSC. In heat pump baseline presentations, the cost of replacement products has been accounted for but the energy use aspect has not been explained.

Any calculation procedure must provide an equitable comparison between products, be technically accurate, and *fully documented*. As AHRI has requested, CEC must provide a technical support document for the LSC and for the HP Baseline. The presentation slides spread over many dockets over many years in insufficient for this purpose. The changes are so significant, AHRI questions if the multipliers used in both TDV and LSC to convert lifecycle dollars per unit of energy ($/kWh, $/therm) to code compliance units of kBTU/kWh and kBTU/therm have changed.

Another example of the need for technical documentation is to explain why LSC splits out energy differently from TDV. LSC has two factors, the "efficiency LSC, which is the sum of LSC energy for space-conditioning, water heating, and mechanical ventilation," and then "total LSC, which includes efficiency LSC and LSC energy from photovoltaic, battery systems, lighting, demand flexibility, and other plug loads."[21] The TDV energy budget included the sum

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[17] *Ibid.*
[18] 2025 Joint Appendices, Appendix JA3 – Energy Budget, pg. 58
[19] Per section JA3.1.2 of Appendix JA3 – Energy Budget from the draft 2025 Joint Appendices
[20] Slide 8 of CEC Presentation - 2022 Building Standards -Time Dependent Valuation (TDV) & Hourly Source Energy (Docket 21-IEPR-06, TN# 239439)
[21] Title 24-2025 Pre-rulemaking Express Terms, Section 10-109 – COMPLIANCE SOFTWARE, ALTERNATIVE COMPONENT PACKAGES, EXCEPTIONAL METHODS, DATA REGISTRIES AND RELATED EXTERNAL DIGITAL DATA SOURCES, ALTERNATIVE RESIDENTIAL

of the energy for space-conditioning, indoor lighting, mechanical ventilation, photovoltaic (PV) and battery storage system, and service water heating and covered process loads.

In the 2022 Energy Code, the proposed building is required to separately comply with the source energy budget and the TDV energy budget. AHRI notes that ASHRAE Standard 90.1's performance path includes the cost of energy used for components of the building with requirements in Sections 5 through 10 of the standard in the regulated energy cost. This includes the cost of energy used for HVAC, lighting, service water heating, motors, transformers, vertical transportation, refrigeration equipment, computer-room cooling equipment, and other building systems, components, and processes with requirements prescribed in Sections 5 through 10. Unregulated energy cost is the cost of energy used for all other end-uses in the building, mostly covered processes. CEC must explain why changes were made to the package of energy-using equipment when calculating the objective for LSC compared to TDV. Confirming how accounting is being done for required on-site renewables is unclear. Is LSC being compared on a net basis or only grid-based electrical energy? CEC must also explain the divergence from the approach adopted by ASHRAE Standard 90.1, the national model energy code.

The Energy Policy Conservation Act (EPCA) requires credits be awarded for compliance on a "one-for-one equivalent energy use or equivalent cost basis."[22] This issue was discussed in *Buildings Industry Ass'n of Washington v. Washington State*[23] where the court held that EPCA recognized that a perfect 1:1 credit ratio is impossible given the different types of technologies, building types, and climate zones at play, but EPCA requires that credit ratios not be so skewed that they effectively discriminate between products and building methods. The Washington State Code did not fail the preemption test because that code assigned credits that are even-handed and not unfairly weighted. To avoid preemption, "Subsection C [of EPCA's statutory conditions] provides that where a building code grants credits for reducing energy use, the code must give credit in proportion to energy use savings, without favoring certain options over others."[24]

EPCA also requires that the estimated energy use of any covered product permitted or required in the code, *or used in calculating the objective*, is determined using the applicable test procedures prescribed under Section 6293, except that the State may permit the estimated energy use calculation to be adjusted to reflect the conditions of the area where the code is being applied if such adjustment is based on the use of the applicable test procedures prescribed under section 6293 of this title or other technically accurate documented procedure.[25] The term "energy use"[26] means the quantity of energy directly consumed by a consumer *product at point of use*, determined in accordance with test procedures under 42 USC § 6293. [*emphasis added*]

FIELD VERIFICATION PROTOCOLS, ELECTRONIC DOCUMENT REPOSITORIES, PHOTOVOLTAIC, AND BATTERY STORAGE SYSTEM REQUIREMENT DETERMINATIONS (Docket 21-BSTD-01, TN# 252915)

[22] 42 U.S.C. § 6297(f)(3)(C)

[23] *Buildings Industry Association of Washington v. Washington State*, 683 F.3d 1144, (Cal. 2012).

[24] *Id*. at 1154.

[25] 42 USC § 6297(f)(3)(G)

[26] 42 USC § 6291(4)

AHRI questions whether the adjustments proposed by CEC to modify the estimated energy use of covered products may stray too far from adjustment required to reflect California conditions. With the TDV and source energy metrics, the 2022 energy code has all the elements necessary to reflect California conditions. Modifying the source energy metric to include *forecasted long-term changes* in powerplant capacity drastically skews proportionality of credit ratios and may go beyond the necessity outlined in EPCA.[27]

Comparing the little information available on LSC to methodology used by DOE during Appliance Standards rulemakings, is very stark. As part of the National Energy Savings (NES) Analysis DOE takes estimated energy consumption and savings based on site energy and converts the energy consumption and savings to primary and full-fuel-cycle (FFC) energy using annual conversion factors derived from the most recent version of the National Energy Modeling System (NEMS).[28] This is not unlike what CEC requires of a metric for to evaluation of cost-effectiveness for proposed measures and for use within Title 24's compliance software for the performance approach.

DOE's procedures for converting site to FFC energy are detailed in robust Technical Support Document (TSD) and supported by policy statements.[29] In the NES Analysis, DOE calculates the cumulative energy savings as the sum of the annual NES. Inputs to the NES analysis include annual energy consumption per unit and site-to-power-plant, FFC conversion factors, shipments, and stock. DOE's FFC calculations incorporate the energy consumed in extracting, processing, and transporting or distributing source fuels (upstream activities), DOE developed FFC multipliers using the data and projections generated by the NEMS used for *AEO2023*.[30,31] As an example, recently published Commercial Water Heaters Final Rule TSD, provides FFC multipliers are provided for the 2026-2050, nearly the full 30-year analysis period. It is held constant after 2050, as that is the last year in the *AEO2023* projections. Beyond that, there is likely too much uncertainty for forecasting. The FFC multiplier for electricity reflects the shares of various primary fuels in total electricity generation throughout the forecast period. The complete methodology associated with this approach is in the thorough TSD, but it provides a technically accurate documented procedure to shift from estimated site energy use determined using the applicable test procedure to a metric more reflective of emissions and energy cost. Comparatively, CEC's documentation of LSC in the Title 24-2025 Docket is lacking in detail and justification of need.

LSC is also intended to prove measures to be cost effective. While AHRI understands the importance of time that energy is used is as important as the amount of energy used, AHRI

[27] 42 U.S. Code § 6297(f)(3)(C)
[28] For more information on NEMS, refer to EIA. The National Energy Modeling System: An Overview. 2018. EIA: Washington, D.C. DOE/EIA–0581(2018). Available at www.eia.gov/outlooks/aeo/.
[29] DOE's FFC Statement of Policy (76 FR 51282 (August 18, 2011), as amended at 77 FR 49701 (Aug. 17, 2012), available, here: https://www.regulations.gov/docket/EERE-2010-BT-NOA-0028
[30] The AEO2023 provides extensive information about the energy system, including projections of future oil, natural gas, and coal supplies; energy use for oil and gas field and refinery operations; and fuel consumption and emissions related to electric power production.
[31] Refer to Table 10.3.3 of the DOE Final Rule Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Commercial Water Heating Equipment. July 28, 2023.

questions whether the forecasting over 30-years, and multiple equipment purchases, is accurate or technically correct. For each Energy Code cycle, the cost of construction has increased. In some code editions, the increase in cost has been substantial. For example, the 2019 Energy Code increased the initial cost of a single-family house average cost, which ranges, depending on climate zone it is built in, between $8,205 and $17,511.[32] In the 2022 Energy Code, a group of measures is required when performing alterations to single-family and low-rise multifamily buildings: cool roofs, low-sloped roof insulation, electric replacement heating equipment, duct sealing, duct insulation, and attic insulation. Nonresidential alterations are impacted by the new 2022 Energy Code approach to calculate the fan power allowance. This measure affects fan systems in all prototypes and affects nearly the entire nonresidential building stock.

In the 2022 Energy Code Impact Analysis, CEC estimated a 5% replacement rate for HVAC measures. CEC estimated the shares of gas and electric appliances for water heating and space heating of single-family and multifamily buildings: 82.8% of single-family space heating is served by gas appliances; 94.9% of single-family water heating is served by gas appliances; 46.6% of single-family space heating is served by gas appliances; and 97.0% of multifamily water heating is served by gas appliances.[33] The costs associated with code required measures for alternations do not seem to be accounted for in the 30-year analysis period in CEC's proposal. CEC must account for replacement costs in the cost methodology because it is substantial and may be impactful to California home and business owners.

Prescriptively required Space and Water Heating Systems are Overly Prescriptive, Particularly for Nonresidential Buildings

The CEC should not prescriptively limit appropriate system choices that provide important energy efficiency improvements. These business-level decisions are made on a case-by-case basis, and the CEC should not exclude energy efficiency-improving technologies. The proposed changes for offices and schools in Section 140.4 – Prescriptive Requirements for Space Conditioning Systems limit consumer choice to an unsuitable degree. There are also technical issues with this section, discussed below.

AHRI opposes the proposed prescriptive requirement that offices must use either a VRF and DOAS or a four-pipe fan coil (FPFC) with heating hot water supplied by an air-to-water heat pump (ATWHP) and DOAS for ventilation for all climate zones. For schools, only one prescriptive system choice exists – an FPFC with ATWHP and DOAS –which is even worse. Why were VRF or commercial packaged heat pumps, both commonly installed in schools, not considered?

There are no broadly accepted industry definitions of air-to-water heat pumps in the U.S. Air-to-water heat pumps can provide space heating, space heating and cooling, space heating and domestic hot water, or space heating, cooling and domestic hot water. There are a variety of space heating applications, including in-floor (radiant) heating, heating through radiators, pre-

[32] CEC Memo with Signed Form 399 for the 2019 Energy Code, Title 24, Parts 1 and 6 (: 17-BSTD-02, TN#: 225059)
[33] CEC 2022 Energy Code Impact Analysis & Certification of Federal Equivalency. (Docket 21-BSTD-01, TN# 250892)

heating domestic hot water using an indirect tank with hydronic coil, and heating using hydronic air handlers. The temperature of water for end-uses can be high, medium, or low temperature, depending on the application.

Air-to-water units designed exclusively to heat potable water are federally regulated commercial or consumer water heaters. Regarding commercial heat pump water heaters: applications are more challenging than consumer applications but are commercial HPWH technologies are advancing. [34] The requirements outlined in Section 140.0(a)3.C cannot be applied to those federally regulated products. Even for equipment that may be outside the scope of federal regulation, there are no industry consensus test procedures and no industry certification programs.

Several questions arise when pondering over air-to-water units: What assurance will California consumers have when sourcing this equipment? How are these products being modeled? What market research has California conducted that indicates that there is sufficient availability of air-to-water heat pumps with rated capacities exceeding 20-ton?

AHRI is concerned that Californian building owners may struggle to comply with these overly prescriptive requirements, especially as they apply to additions and alterations of nonresidential buildings.

Proposed requirements in Section 141.0 – Additions, Alterations, and Repairs to Existing Nonresidential, and Hotel/Motel Buildings, specifically section 141.0(b)2.C.ii detail extreme limitations on replacement equipment. For a building owner to replace a piece of equipment not on the list, in kind, would no longer be permissible in the prescriptive path. Instead, performance modeling would need to be undertaken, and extensive energy tradeoffs will be required to replace equipment not explicitly listed in Section 141.0(b)2.C.ii, which likely to result in delays and significant additional expense that CEC has not justified. What will happen to already overtaxed school systems that cannot easily replace broken space heating equipment in the winter?

In addition, there appears to be capacities of systems not accounted for in Section 141.0(b)2.C.ii for *New or replacement of single-zone packaged rooftop systems*. The preamble to section 141.0(b)2.C.ii specifies a cooling capacity limit of 65,000 Btu/h when scoping the section. An alternate compliance path when installing an air-conditioner and furnace is Table 141.0–E–1, which only addresses units with rated capacity <54,000 Btu/h. What requirements are applicable to packaged rooftop systems with a rated cooling capacity ≥54,000 Btu/h but <65,000 Btu/h?

[34] In DOE's Energy Conservation Standards Final Rule for Commercial Water Heating Equipment (Pre-published 7/18/23), DOE notes that "[it] did not consider commercial integrated heat pump water heaters [standards] in this final rule. DOE found only one such model on the market, at a single storage volume and heating capacity. Given the wide range of capacities and stored water volumes in products currently on the market, which are required to meet hot water loads in commercial buildings, it is unclear based on this single model whether heat pump water heater technology would be suitable to meet the range of load demands on the market. Similarly, based on the information currently available and comments regarding the performance of heat pump water heaters as compared to electric resistance water heaters in commercial settings, it is uncertain if split-system heat pump water heaters can serve all the applications currently filled by electric instantaneous water heaters." (p.53)

Technical Review of the Express Terms

AHRI reviewed the Express Terms and conducted a a technical review and developed recommendations to address concerns below.

A. TABLE 110.2-A AIR CONDITIONERS AND CONDENSING UNITS – MINIMUM EFFICIENCY REQUIREMENTS

CEC has proposed modifications to Table 110.2-A to cite federal minimums for condensing units rated to AHRI Standard 365. There are no federal minimums for air-, water-, or evaporatively-cooled condensing units ≥135,000 rated to AHRI 365. Further, there is no methodology for these condensing units to have an IEER rating. ASHRAE 90.1 only specifies EER for this equipment in Table 6.8.1-1. AHRI Standard 340/360 does not include a rating procedure that allows for rating condensing units as outdoor units with no match, like it is found in AHRI Standard 210/240 for residential central air conditioners and heat pumps. AHRI recommends CEC strike "Federal Minimum" and "IEER" from Table 110.2-A.

B. TABLE 110.2-F~~G~~ Electrically Operated Variable Refrigerant Flow (VRF) Air Conditioners Minimum Efficiency Requirements and TABLE 110.2-GH Electrically Operated Variable Refrigerant Flow Air-to-Air and Applied Heat Pumps - Minimum Efficiency Requirements

Federal efficiencies for VRF equipment are changing on January 1, 2024. At that time, the federally regulated metric will change from full load EER to part-load IEER. AHRI Standard 1230, "*2021 Standard for Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment*" (AHRI 1230–2021), which is referenced in ASHRAE Standard 90.1–2022, is also cited as the federal test procedure. While the IEER levels did not change from ASHRAE 90.1-2019 to the 2022 edition, many test procedure changes make those same values more stringent when using the AHRI 1230-2021 compared to the older test procedure, cited in ASHRAE 90.1-2019. To appropriately accommodate the test procedure changes, EER values were necessarily lowered in ASHRAE 90.1-2022. AHRI recommends CEC adopt equipment efficiencies for VRF cited for "on or after 1/1/24" in ASHRAE 90.1-2022 Table 6.8.1-8, Electrically Operated Variable-Refrigerant-Flow Air Conditioners and 6.8.1-9, Electrically Operated Variable-Refrigerant-Flow and Applied Heat Pumps into Title 24-2025 Tables 110.2-F and 110.2-G, as appropriate.

CEC also has referenced AHRI 1230 and IEER levels for air-cooled, three-phase VRF multi-split air conditioners and heat pumps with cooling capacity less than 65,000 Btu/h. While AHRI is not aware of any products on the market, these are covered by AHRI Standard 210/240-2023 with efficiencies in SEER2/HSPF2 metrics.[35] AHRI

[35] Air-cooled, single-phase VRF multi-split air conditioners and heat pumps with cooling capacity less than 65,000 Btu/h are considered residential central air conditioners and heat pumps and are regulated under the energy

recommends CEC adopt equipment efficiencies cited for "on or after 1/1/23" in Table 6.8.1-8, Electrically Operated Variable-Refrigerant-Flow Air Conditioners and Table 6.8.1-9, Electrically Operated Variable-Refrigerant-Flow and Applied Heat Pumps into Title 24-2025 Tables 110.2-F and 110.2-G, as appropriate.

C. SECTION 120.1 – REQUIREMENTS FOR VENTILATION AND INDOOR AIR QUALITY

Recent editions of the Energy Code have sought to align California nonresidential ventilation requirements with ASHRAE Standard 62.1. AHRI notes that equations and minimum occupant load densities in Section 120.1 diverge from ASHRAE 62.1. The 2025 Energy Code is still citing the 2019 edition of ASHRAE 62.1. AHRI requests CEC consider modifying the reference to ASHRAE 62.1-2022 and adopt into TABLE 120.1-A– Minimum Ventilation Rates, *Minimum occupant load density* (# persons / 1000 ft^2) and *Area-based minimum ventilation rate* (cfm / ft^2) values in Table 6–1 of ASHRAE 62.1–2022. AHRI also requests that CEC adopt ASHRAE 62.1–2022 equation 6-1 to maximize harmonization.

D. SECTION 120.6 – MANDATORY REQUIREMENTS FOR COVERED PROCESSES

In mandatory sections, the 2022 Energy Code erroneously includes prescriptive requirements for commercial refrigeration systems and equipment that are federally and state regulated. In the Code of Federal Regulations, covered equipment, by definition, includes commercial refrigerator, freezer, or refrigerator-freezer, as defined in § 431.62 and walk-in cooler and walk-in freezers, as defined in § 431.302. California Code of Regulations, Title 20, Section 1605.1 and 1605.2 includes standards for Refrigerated Warehouses. Title 24 includes additional prescriptive requirements for mechanical systems serving refrigerated spaces is inappropriate, regardless of size. While the spaces may have size limitations, the equipment does not. AHRI recommends CEC add two exemptions to resolve this issue:

- Exception 4 to Section 120.6(a)3B: Evaporators covered by California Code of Regulations, Title 20, Sections 1605.1 and 1605.2

- Exception 1 to Section 120.6(a)4: Condensing units covered by California Code of Regulations, Title 20, Sections 1605.1 and 1605.2

E. SECTION 140.4 – PRESCRIPTIVE REQUIREMENTS FOR SPACE CONDITIONING SYSTEMS

AHRI notes that Section 140.4(a)2 allows single-zone direct expansion cooling systems <240,000 Btu/h in retail and grocery buildings, schools, offices, and financial institutions to be air-source air conditioners with furnaces or heat pumps or dual-fuel heat pumps as applicable. Thus, the requirement to install an air-to-water heat pump or a VRF systems with DOAS for ventilation only applies to offices and school buildings when the

conservation program for consumer products. (10 CFR part 430, subpart B, appendixM1 and 10 CFR part 430, subpart C.)

system's rated capacity > 240,000 Btu/h (20-ton). AHRI recommends eliminating Section 140.4(a)2.

F. SECTION 150.0 – SINGLE-FAMILY RESIDENTIAL BUILDINGS – MANDATORY FEATURES AND DEVICES

AHRI opposes proposed changes to Section 150.0(h) Space conditioning systems. The reference to California Building Code is effectively a reference to section 150(h)1.A on how to calculate cooling and heating load. The language has been moved from §150(h)1B to new §150(h)5 and amended to disallow supplementary heating to meet heating demand. Not only would this lead to extremely oversized systems, especially in cooling mode, causing systems to constantly cycle, CEC addressed backup heat during the 2022 cycle. In response to AHRI comments to the 2022 energy code development, CEC revisited the language proposed in EXCEPTION 1 to Section 150.2(b)1G (and 180.2(b)2Av in the new multifamily section). Language proposed in the 15-day Express Terms, and ultimately adopted into the 2022 code, made clear that electric resistance heating in heat pumps is excluded, avoiding the inadvertent elimination of back-up and supplementary heat. It is common for strip heat to be installed as emergency backup in the event the heat pump becomes inoperable during the heating season. In freezing temperatures, emergency strip heat would prevent pipes from bursting.

G. SECTION 150.1 – PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR SINGLE-FAMILY RESIDENTIAL BUILDINGS

As detailed above, AHRI is concerned about the prescriptive requirements that new space and water heating systems be heat pumps. CEC should immediately issue technical support documenting the changes that support this proposal.

H. SECTION 150.2 – ENERGY EFFICIENCY STANDARDS FOR ADDITIONS AND ALTERATIONS TO EXISTING SINGLE-FAMILY RESIDENTIAL BUILDINGS

AHRI supports the proposal to permit additions to extend existing space heating systems. However, AHRI is concerned that CEC has proposed to delete gas/propane/electric instantaneous water heaters as a permissible option for additional water heaters. CEC should either justify or reconsider this change.

For alterations, AHRI is concerned with the proposal that new space/water heating systems must be heat pumps via prescriptive path. This is substantially different from the proposal made by CEC in August 2023, which is not supported by any technical or cost justification. This change moves this from a voluntary to mandatory requirements. AHRI recommends CEC to reconsider this approach [why?].

Lastly, in 2022, CEC also made edits to EXCEPTION 2 to Section 150.2(b)1G to permit the in-kind replacement of electric resistance heating systems in alterations. Nearly all manufactured housing heating systems are electric furnaces. Duct work in mobile homes is too small to allow a regularly sized furnace to be installed or safely used. As complicated

ties exist between Title 24 and CCR Title 25 - Housing and Community Development, the 2022 code will continue to allow the replacement of electric resistance heating systems in manufactured housing. AHRI recommends that these provisions remain in 2025.

I. SECTION 160.9 – MANDATORY REQUIREMENTS FOR ELECTRIC READY BUILDINGS

AHRI is concerned with certain provisions proposed in Section 160.9(e). The first two provisions, Section 160.9(e)1 and 2, seem to relocate Section 160.4(a). This is acceptable.

AHRI opposes new Sections 160.9(e)3 and 4 because they present several issues. The new section proposes to reserve a space of 39" x 39" for a future heat pump water heater (HPWH) which is quite significant for smaller dwelling units. If a homeowner goes through the performance path to select a gas or electric instantaneous water heater for a small dwelling unit and also be mandated additional floor space is excessive for the homeowner. Section160.9(e)4.C requires two 8" capped ducts, venting to the building exterior. Though the ducts are capped, these requirements would seem to compromise the envelope by creating an unnecessary thermal bridge. Also, future generations of HPWHs may need different infrastructure. AHRI suggests CEC revisit these provisions.

AHRI has significant concerns with the central heat pump water heater ready Section160.9(f). Again, CEC is mandating expensive additional requirements further penalizing gas or propane water heating systems. These requirements are extensive and need to be revisited.

AHRI appreciates the opportunity to provide these comments. If you have any questions regarding this submission, please do not hesitate to contact me.

Sincerely,

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